ME1068

Operating Instructions

ME1068

F.M. SIGNAL GENERATOR

TYPES TF 1066B/2 and TF 1066B/3

MARCONI INSTRUMENTS LIMITED, ENGLAND

SUPPLIED AND SERVICED BY:
MARCONI
INSTRUMENTS
111 CEDAR LANE
ENGLEWOOD N.J.

ME 1068

MARCONI INSTRUMENTS

EB 1066B/2 -B/3
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OPERATING INSTRUCTIONS No. EB 1066B/2 -B/3

for

F.M. SIGNAL GENERATOR

TYPES TF 1066B/2 and TF 1066B/3

AMENDMENTS, where applicable, are included at the end of the handbook.

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DRAWINGS	Ref. No.
OUTPUT ARRANGEMENT DIAGRAMS (follows page 15)	TLC 28189
FUNCTIONAL DIAGRAM (at rear of handbook)	XD 35801
CIRCUIT DIAGRAM & COMPONENT LISTS (at rear of handbook)	XE 34134
MAINS INPUT CONNECTIONS DIAGRAM (at rear of handbook)	TLC 28392

SCHEDULE OF PARTS SUPPLIED

The complete equipment comprises the following items :-

1. One F.M. Signal Generator Type TF 1066B/2 or B/3, complete with valves, etc., as under :-

Valves:	One:	ECC88 (6DJ8), Double Triode.
	One:	EL84 (6BQ5), Pentode.
	One:	OB2 (QS1208), Voltage Stabilizer.
	One:	TD03-10E (CV5458), Disk-Seal Triode.
	One:	6AS6, Pentode.
	One:	6AK5 (EF95), Pentode.
	One:	6BW6, Beam Tetrode.
	Two:	6BW7, Pentodes.
	One:	6CD6G, Tetrode.
	One:	12AU7 (ECC82), Double Triode.
	One:	12AX7 (ECC83), Double Triode.
	One:	5651 (QS1209), Voltage Reference Tube.
Semi-Conductors:	Two:	CTP1109, Junction Transistors.
	One:	GET114, Junction Transistor.
	One:	GET115, Junction Transistor.
	Two:	CG1E, Germanium Diodes.
	One:	CS2A, Silicon Diode.
Lamp:	One:	6.3-volt, 0.15-amp, M.B.C. Pilot Lamp.
Fuses:	Four:	2-amp, glass cartridge.
	One:	250-mA, glass cartridge.
	One:	100-mA, glass cartridge.

2. One Coaxial Free Plug, Type N, for r.f. output socket.

3. One Coaxial Free Plug, Type BNC, for ext. mod. socket.

4. One Telephone Plug, for use with 'phones socket.

5. One Instruction Book No. EB 1066B/2 - B/3.

Schedule of Parts Supplied (continued)

The following accessories are optional items supplied only if specially ordered.

6. Output Lead, 50-ohm, TM 4824; 36 inches long; Type N plug both ends.

7. Attenuator Pad, 6-dB, 50-ohm, TM 4919/1; one end, Type N socket, other end, Type N plug.

8. Attenuator Pad, 20-dB, 50-ohm, TM 4919; one end, Type N socket; other end Type N plug.

9. Matching Unit, 50-ohm to 75-ohm, TM 4918; one end, Type N socket; other end, Belling Lee L734/P plug.

10. Matching Unit, 50-ohm unbalanced to 300-ohm balanced, TM 4916; one end, Type N socket; other end, solder tags.

11. D.C. Isolating Unit, TM 4917; one end, Type N socket; other end, crocodile clips.

12. Coaxial Fuse, TM 5753; prevents damage to the Signal Generator attenuator through accidental application of r.f. or h.t. power to the circuit under test. Useful in transmitter/ receiver testing.

Overload Protection:	Burns out at 0.4 watt.
Insertion Loss:	Nominally 0.5 dB.
V.S.W.R.:	1.35 or less when terminated with a matched 50-ohm load, 1.6 or less when terminated with TF 1066B/2 attenuator.
Connectors:	Type N.
Fuse:	1/16-amp Littelfuse Cat. No. 361.062. 10 spares are supplied.

Schedule of Parts Supplied (continued)

13. A. F. Signal Compressor, TM 6629; a peak limiter for use with multiple-tone external modulation. Varying levels of peak input give a constant low-distortion output for modulating the Signal Generator, which ensures that deviation is independent of the number and amplitude of modulating signals.

Input Requirements:	0.5 to 6 volts sinewave, or up to six simultaneous sinewaves providing maximum peaks do not exceed 8.5 volts peak.
Output:	2 volts r.m.s. ±10% for single sinewave, or 2.8 volts peak ±10% for multiple signals.
Distortion:	Not more than 2%.
Frequency Range:	1 to 100 kc/s.
Power Supply:	200 to 250 volts or 100 to 150 volts, 40 to 500 c/s, 30 watts. Fuses in mains, h.t., and regulated l.t. circuits.

Dimensions:	Height	Width	Depth
	6 3/4 in (17 cm)	21 in (53.5 cm)	$10\frac{1}{2}$ in (27 cm)

DATA SUMMARY

for

F.M. SIGNAL GENERATOR

TYPES TF 1066B/2 and TF 1066B/3

FREQUENCY

Range:	400 to 555 Mc/s in one band, controlled by precision slow-motion drive.
Calibration Accuracy:	Direct accuracy: ±0.5%. Using crystal calibrator: ±0.01% at all 1-Mc/s check points for temperatures between 20° and 60°C. 10-Mc/s markers ensure accurate frequency identification.
Frequency Stability:	After warm-up, drift is not more than 0.0025% in a 10-minute period, and not more than 0.002% for a 10% change in supply voltage.
Attenuator Reaction:	Negligible below 25 mV; not greater than 0.1% above.
Incremental Frequency Control:	Continuously variable from -100 to +100 kc/s. Shift is monitored by meter with two ranges, -20 to +20 kc/s and -100 to +100 kc/s. Accuracy: within ±10% of full-scale.
Spurious Signals:	Total harmonic content is less than 10%. There are no sub-harmonics.

R.F. OUTPUT

Level:	Continuously variable from 0.1 μV to 100 mV across a 50-ohm load. Attenuator dial calibrated in volts across 50 ohms and power in decibels relative to 1 mW in 50 ohms.

Data Summary (continued)

Source Impedance:	50 ohms; v.s.w.r. not greater than 1.2: 1.
Output Accuracy:	±1 dB for supply voltage variations up to ±10%.
Stray Radiation:	Negligible; permits full use of lowest output.

FREQUENCY MODULATION

Internal:	Modulation frequencies: 1 and 10 kc/s. Deviation variable up to 300 kc/s and indicated on meter with two ranges; 0 to 150 and 0 to 300 kc/s.
External:	Modulation frequency range: 100 c/s to 100 kc/s. Deviation as for internal, and determined by front-panel control.
Deviation Accuracy:	Within ±10% of f.s.d. Accuracy over external modulation range is within ±5% of accuracy at 10 kc/s for a constant level of sinewave input.
External Modulation Requirements:	Normal ext. f.m.: not more than 2 volts r.m.s. into 50 kΩ or greater for 300 kc/s deviation. Limited ext. f.m.: inputs between 2 and 8 volts r.m.s. into 50 kΩ or greater give substantially constant deviation at any value up to 300 kc/s. The maximum peaks of complex signals should not exceed 11 volts (or 20 volts if more than 3% distortion can be tolerated). Complex ext. f.m.: up to six sinusoidal inputs can be applied simultaneously in either 'normal' or 'limited' operation. (See also A.F. Signal Comressor under Accessories Available.)

Data Summary (continued)

Modulation Monitor:	A peak-to-peak monitor comprising a voltage doubler with long time constant. The meter indicates the peak deviation within ±10% provided the maximum peaks occur at least 30 times a second.
Modulation Distortion:	Not greater than 3% of fundamental at maximum deviation.
Residual F.M.:	The f.m. due to hum and noise is less than 100 c/s deviation.
POWER SUPPLY:	200 to 250 volts, or 100 to 150 volts after adjusting internal links, 40 to 500 c/s; 90 watts. Models supplied ready for immediate 100- to 150-volt use if specified when ordering. Fuses in mains, h.t., and regulated l.t. supplies.

DIMENSIONS & WEIGHT: (in case for bench use)

Height	Width	Depth	Weight
15 1/4 in (39.5 cm)	21 in (53.5 cm)	10½ in (27 cm)	54 lb (24 kg)

1 INTRODUCTION

The Marconi TF 1066B/2 Signal Generator covers the carrier frequency range 400 to 555 Mc/s and provides c.w. or f.m. signals at a source impedance of 50 ohms.

Precise control of frequency is ensured by a crystal calibrator giving check points at 1- and 10-Mc/s intervals throughout the band, and an 8-inch tuning dial with staggered scales calibrated every megacycle.

There is a continuously-variable incremental frequency control, which covers a range of plus and minus 100 kc/s at any carrier frequency; increments are read on a front-panel meter calibrated with two ranges.

Frequency modulation can be applied internally at 1 or 10 kc/s, or externally between 100 c/s and 100kc/s. In both cases, deviation is variable up to 300 kc/s and is monitored by a meter with scales of 150 and 300 kc/s. An additional facility, called 'Limited External Modulation', introduces a limiter into the modulation circuit, and results in a substantially constant deviation with negligible distortion for any input between 2 and 8 volts. A complex modulating signal can be applied on both normal and limited external modulation.

A high-quality 50-ohm output is obtained via a piston attenuator, and the attenuator dial is calibrated in volts across a 50-ohm load and power in decibels relative to 1 milliwatt into 50 ohms.

The TF 1066B/3 is electrically identical with the TF 1066B/2. Both instruments have front panels ready drilled for fitting into a 19-inch rack, but the B/2 is supplied in a bench-mounting case and the B/3 in a dust cover.

2 OPERATION

2.1 INSTALLATION

Signal Generator Type TF 1066B/2 can be adjusted for operation from any 40- to 500-c/s mains supply in the voltage ranges 100 to 150 volts and 200 to 250 volts.

Unless otherwise specified, the Signal Generator is normally despatched ready for immediate operation from 240-volt supplies.

2.2 SWITCHING ON

Check first that the instrument is correctly adjusted for the local supply mains voltage, then connect the mains lead to a suitable supply socket; the lead is permanently attached to the instrument, and is stowed in the right-hand case-handle recess. Switch on by means of the SUPPLY switch - the red pilot lamp should glow.

Before proceeding further, wait for a few minutes, for the valves and internal circuit to warm up. If a reasonable order of stability is required, extend this period to about half an hour, or for the full rated stability, to a few hours.

2.3 TUNING

The instrument covers its frequency range of 400 to 555 Mc/s in a single band. Its 8-inch diameter tuning dial is calibrated every megacycle throughout the range; for high discrimination with ease of use, the calibrations are staggered over five concentric scales. On inspecting the scales, it will be seen that the lowest frequency calibration (400 Mc/s) is on the left-hand extremity of the innermost scale; the 401- to 404-Mc/s calibrations are on the extreme left-hand edges of the other four scales, progressing to the outermost scale. Every subsequent five calibration points are treated in the same way as for the first five mentioned above. The user should see quite clearly the method of using the scales, by rotating the frequency control very slowly and watching the calibration marks on the various scales as they pass beneath the cursor hair-line.

2.3 (continued)

The tuning facilities are as follows :-

(1) The carrier can be set by means of the tuning control to any pre-determined frequency as read directly from the tuning dial.

(2) The carrier frequency can be checked against the internal crystal calibrator at every megacycle; 10-Mc/s crystal check points are also available independently of the 1-Mc/s eheck points, and are useful for locating the cursor correctly on the frequency scales (see Section 2.3.2).

(3) The continuously-variable incremental frequency control can be used for shifting the carrier frequency by any amount up to 100 kc/s in either direction, monitored on the MODULATION & INCREMENTAL FREQUENCY meter with two scales - -100 to +100 kc/s and -20 to +20 kc/s (see Section 2.3.3).

2.3.1 General Procedure

To tune the Signal Generator to a particular frequency, proceed as follows :-

(1) Set the main selector switch to C.W.

(2) Set the frequency dial to the desired frequency as indicated on the appropriate scale (see first para. of Section 2.3).

(3) By means of the SET CARRIER control, set the CARRIER LEVEL meter pointer to the SET CARRIER mark.

(4) Set the monitor selector, or MOD. & INC. FREQ. switch to INC. FREQ. 20 kc/s, and set the meter pointer to centre-zero by means of the continuously-variable INC. FREQ. control.

2.3.2 Crystal Check

The built-in crystal calibrator can be switched to provide check points at every megacycle over the entire tuning range of the instrument, or check points at every 10-Mc/s interval.

To use these facilities, proceed as follows :-

(1) Set up the frequency desired.

2.3.2 (continued)

(2) Turn the main selector switch to XTAL. CAL. 10 Mc/s or XTAL. CAL. 1 Mc/s, as appropriate. As a preliminary check, it may be considered advisable to check the cursor position at a 10-Mc/s point near the frequency which will subsequently be set up.

(3) Plug a pair of high-resistance headphones into the PHONES jack on the front panel. A beat note should be heard in the headphones if the crystal harmonic and the carrier frequency are sufficiently close. Adjust the CAL. GAIN control as necessary.

(4) Gently rotate the frequency control to locate the zero-beat point. For maximum accuracy of zero beat, swing the frequency dial through the null point once or twice to find the exact centre between the two points where the audio note disappears.

(5) Ascertain that the frequency chosen for checking is aligned with the cursor. If it is not, rotate the whole frequency-dial cover and cursor to achieve alignment.

Once set, the dial cover/cursor can be locked in position by turning the small chromium-plated knob near the top of the front panel.

2.3.3 The Incremental Frequency Control

Having tuned the Signal Generator to the desired frequency as described in Section 2.3.1, proceed as follows :-

(1) Select by means of the MOD./INC. FREQ. switch, the MODULATION & INCREMENTAL FREQUENCY meter range appropriate to the shift subsequently to be applied, i.e., INC. FREQ. 20 kc/s or INC. FREQ. 100 kc/s.

(2) Set up the required increment or decrement by means of the INC. FREQ. control, reading the shift on either of the two lower meter scales, i.e., 20-0-20 kc/s or 100-0-100 kc/s.

NOTE: When changing the direction or decreasing the magnitude of shift, special reference should be made to Section 2.3.4, 'Modulator Hysteresis'.

The incremental frequency accuracy is within ±10% of meter full-scale.

2.3.4 Modulator Hysteresis

When making incremental frequency shifts as described in Section 2.3.3, the operator may find some inconsistency of results due to inherent hysteresis in the ferrite reactor.

The effects of this hysteresis are only of significance when the operator makes a frequency shift in a direction different from that previously applied, i.e., when the shift is (i) changed from a positive to a negative value, or vice versa, or (ii) decreased to, or towards, zero. If the shift is increased to a particular value from the true (neutralized) zero, and then further increased, the hysteresis problem does not arise.

Errors due to hysteresis will generally be small - of the order of 5% of the shift - and can be eliminated by 'wiping' or neutralizing the magnetic circuit of the modulator before making a reversal of frequency shift. As a point of good practice, this neutralizing should also be carried out before commencing any measurements involving use of the incremental frequency control.

To neutralize modulator hysteresis, first set the incremental shift to zero and apply f.m. to the carrier; then, having set the deviation initially to maximum, reduce it slowly to zero. With the modulator now neutralized, it may be advisable to check that the Signal Generator is still correctly tuned to the centre frequency of the equipment under test; if necessary, make a slight adjustment to the tuning control, and perhaps crystal-check the frequency.

The following example shows the points at which, in a typical sequence of frequency shifts, it is desirable to neutralize the modulator.

2.3.4 (continued)

Example: In a receiver response investigation, it is required to shift the carrier +50, +75, +100 kc/s, and then to drop back in frequency and recheck results at +50 kc/s.

Do this by (i) neutralizing at zero shift,
(ii) setting to +50 kc/s,
(iii) setting to +75 kc/s,
(iv) setting to +100 kc/s,
(v) returning to zero and neutralizing again,
and (vi) setting to +50 kc/s.

2.4 SETTING UP FOR C.W. OR F.M. OUTPUT

The r.f. output from the TF 1066B/2 can be continuous-wave or internally frequency-modulated at either 1 kc/s or 10 kc/s, or externally frequency-modulated at frequencies from 100 c/s to 100 kc/s.

2.4.1 Continuous-Wave

(1) Set the main selector switch to C.W.

(2) Tune to the desired frequency in the manner described in Section 2.3.1.

(3) Set the ATTENUATOR control for the required output as indicated on the attenuator dial. A detailed explanation of the method of setting the r.f. output voltage is given in Section 2.5, R.F. OUTPUT ARRANGEMENTS.

(4) Throughout tests subsequently made, always keep the CARRIER LEVEL meter pointer at the SET CARRIER mark, and the modulation meter pointer at zero on the INC. FREQ. 20 kc/s range.

2.4.2 Precautions Against Spurious Modulation

Although every effort has been made to produce a design giving freedom from microphony, it is not possible to eliminate this type of spurious modulation altogether. The user is therefore advised to take normal precautions for preventing the excitation of modulation due to microphony.

2.4.2 (continued)

For example, if the Signal Generator is to be used for signal-to-noise ratio or similar measurements where spurious modulation is particularly undesirable, it is an advantage to stand it on a sponge rubber or felt mat. If a receiver under test delivers a high a.f. output, its loudspeaker should be directed away from the Signal Generator, or - better still - disconnected.

2.4.3 Frequency Modulation

The accuracy of the deviation indication and the waveform of the demodulated signal may tend to deteriorate slightly when carrier shift is applied by means of the INC. FREQ. control. It is generally advisable, therefore, to keep this control in its zero position when using frequency modulation.

(A) Internal F.M.

(1) Set the main selector switch to INT. F.M. 1 kc/s or INT. F.M. 10 kc/s, as required.

(2) Tune the Signal Generator, and adjust the SET CARRIER and ATTENUATOR controls as described in Section 2.4.1.

(3) Set the monitor selector switch to either MOD. 0-150 or MOD. 0-300, according to the deviation to be used, and, reading the deviation level on the appropriate scale on the meter, i.e., 0-150 or 0-300 kc/s, set the deviation by means of the SET MODULATION control.

(B) External F.M.

(1) Set the main selector switch to EXT. F.M.

(2) Connect the external a.f. signal source to the EXT. MOD. F.M. socket.

(3) Tune the instrument and adjust the SET CARRIER and ATTENUATOR controls to produce the required output, as described in Section 2.4.1.

2.4.3 (continued)

(4) Set the monitor selector switch to MOD 0-150 or MOD 0-300, depending on the deviation to be used, and, reading the deviation level on the appropriate scale on the meter, set the deviation by means of the SET MODULATION control.

The impedance presented at the EXT. F.M. inlet is approximately 50 kΩ or greater. An input of not more than 2 volts r.m.s. will provide the maximum deviation of 300 kc/s.

(C) Limited External F.M.

This facility introduces a limiter into the modulator input circuit, and an input of between 2 and 8 volts r.m.s. provides a deviation which is substantially constant, and has negligible distortion.

(1) Set the main selector switch to LTD. EXT. F.M.

(2) Connect the external a.f. signal source to the EXT. MOD. F.M. socket.

(3) Tune the Signal Generator and adjust the SET CARRIER and ATTENUATOR controls to produce the required output, as described in Section 2.4.1.

(4) Set the monitor selector switch to MOD. 0-150 or MOD. 0-300, according to the deviation to be used, and, reading the deviation level on the appropriate scale on the meter, set the deviation by means of the SET MODULATION control.

A complex modulating signal comprising up to six sinusoidal components can be applied, on both normal and limited external modulation. Since the limiting device in the instrument limits according to the r.m.s. value of a waveform, and not the peak value, errors are likely to be introduced, depending on the amplitudes and phase relationships of the fundamental components of the waveform. When complex signals are to be used under Limited External F.M. conditions, therefore, it is recommended that the A.F. Signal Compressor Type TM 6629, an optional accessory, be used, since this limits according to the peak value of a waveform. For details of the Compressor, see Schedule of Parts Supplied, page v.

2.5 R.F. OUTPUT ARRANGEMENTS

For consideration of its output circuit, the TF 1066B/2 can be regarded as a zero-impedance voltage generator in series with a resistance of 50 ohms. This condition is shown diagrammatically in figure 1 of drawing No. TLC 28189, where E is the source e.m.f., R_O is the source impedance of the Signal Generator, Z_L is the load impedance, and V_L is the voltage actually developed across the load.

The Attenuator Dial. This dial has two scales : one is calibrated from -128 to -7 and denotes the output in decibels relative to 1 mW into a 50-ohm load; the other is calibrated directly in units of voltage across a 50-ohm load.

With the SET CARRIER control adjusted to bring the CARRIER LEVEL meter pointer to the SET CARRIER mark, the attenuator scales are direct reading, each in its particular units as described in the previous paragraph.

2.5.1 Output Accessories

OUTPUT LEAD Type TM4824. This is a 50-ohm coaxial cable 30 inches long and fitted at either end with a standard type N free plug (Great Britain, Transradio Ltd. type GE.071: United States, Military No. UG-21B/U). These plugs mate with either standard type N free sockets (Great Britain, Transradio Ltd. type BEa.071/50; United States, Military No. UG-23B/U) or panel mounting type N sockets (Great Britain, Transradio Ltd. type DE.071; United States, Military No. UG-22B/U).

20-dB ATTENUATOR PAD Type TM 4919. This is a conventional π-section attenuator pad with 20 dB insertion loss. The input resistance and output resistance are each 50 ohms. The applications of this pad are dealt with in Section 2.5.2, which follows. It is fitted with a type N socket at one end and a type N plug at the other end.

6-dB ATTENUATOR PAD Type TM 4919/1. This pad has an insertion loss of 6 dB but is otherwise similar to the 20-dB Pad Type TM 4919.

2.5.1 (continued)

50-OHM to 75-OHM MATCHING UNIT Type TM4918. For details of the electrical action of this unit, refer to Section 2.5.2(C). When fitted, it converts the effective source impedance of the Signal Generator from 50 ohms to 75 ohms. The Matching Unit is fitted with a Type N socket at its input end and a Belling Lee plug Type L734/P at its output end; this plug mates with a Belling Lee free socket Type L734/J or panel-mounting socket Type L604/S.

50-OHM to 300-OHM UNBALANCE TO BALANCE TRANSFORMER Type TM 4916. The electrical action of this unit is described in Section 2.5.2 (D), and it is used when the output of the Signal Generator is applied to a balanced-winding input circuit. The unit gives a line-to-line source impedance of 300 ohms. It contains resistive elements only and is not suitable for matching into balanced input circuits which are not in the form of windings. It is fitted with a type N socket at its input end and solder spills at its output end.

D.C. ISOLATING UNIT Type TM 4917. This unit contains a 300-volt-working 0.001-μF capacitor connected in series with the output line so that the Signal Generator may be connected to a point of high d.c. potential on the equipment under test. The Isolating Unit is fitted with a Type N socket at its input end and two crocodile clips at its output end.

COAXIAL FUSE Type TM 5753. This unit is connected in series with the Signal Generator output; it prevents damage to the instrument's attenuator through accidental application of r.f. or h.t. power to the circuit under test. For characteristics, see Schedule of Parts Supplied, page iv.

A.F. SIGNAL COMPRESSOR Type TM 6629. This self-contained unit is a peak limiter for use with multiple-tone external modulation. Varying levels of peak input give a constant low-distortion output for modulating the Signal Generator, which ensures that deviation is independent of the number and amplitude of modulating signals. For characteristics, see Schedule of Parts Supplied, page v.

2.5.2 Coupling to the Equipment under Test.

The output impedance of the Signal Generator is nominally equal to the characteristic impedance of the output lead. This cable may therefore be regarded as correctly terminated at its input end; serious errors in the apparent e.m.f. caused by standing waves on the cable can therefore generally be neglected even when the input impedance of the equipment under test is not equal to 50 ohms.

However, it is often important that for other reasons the source impedance is accurately matched to the load or that it has a particular known value not equal to 50 ohms. Under these circumstances, the source impedance at the output end of the system can be altered to the required value by the use of various matched networks. The paragraphs which follow give details of the various methods of coupling the Signal Generator via a selection of resistive impedance-correcting networks.

(a) Coupling from the 50-ohm Source

When the equipment under test has an input impedance other than 50 ohms and it is important that the signal is derived via a 50-ohm resistive source impedance, it is advisable, if the insertion loss can be tolerated, to couple the output lead to the equipment via the 50-ohm 20-dB Attenuator Pad.

With the Pad in circuit, the possibility of error in apparent e.m.f. or effective output impedance due to standing waves is avoided because it is impossible to mis-match the cable seriously - variations in the load impedance from zero to infinity cause the effective line-terminating resistance to depart from its correct value by only 1 ohm approximately.

Figure 2 on Drawing No. TLC 28189 (following page 15) shows diagrammatically the effect of connecting the Pad into circuit. The final output conditions are equivalent to those of a zero-impedance generator producing e.m.f. equal to E/10 in series with a resistance, R_{EO}, of 50 ohms. The p.d. across the load can, of course, be calculated in the usual way and is equal to:

2.5.2 (continued)

$$\frac{E}{10} \times \frac{Z_L}{R_{EO} + Z_L}$$

where E is the e.m.f. indicated on the Attenuator dial.

R_{EO} is the effective source resistance of the Signal Generator (50 ohms)

Z_L is the input impedance of the equipment under test.

If, however, the insertion loss of the 20-dB Pad cannot be tolerated, the 6-dB Attenuator Pad may be used instead. Although this Pad does not isolate the Signal Generator impedance from the load to the same degree as its 20-dB counterpart, it will usually be effective enough for all normal applications.

The final output conditions with the 6-dB Pad connected are equivalent to those of a zero-impedance generator producing an e.m.f. equal to E/2 in series with a resistance of 50 ohms. The p.d. across the load is of course, equal to

$$\frac{E}{2} \times \frac{Z_L}{R_{EO} + Z_L}$$

(b) Source Resistance Less Than 50 ohms

If the required source resistance is less than 50 ohms, the arrangement shown in figure 3 of TLC 28189 can be used. The resistance R_p is effectively in parallel with the source resistance of the Signal Generator so that the output resistance of the system, R_{EO}, is given by the standard expression for resistances in parallel;

2.5.2 (continued)

viz:

$$R_{EO} = \frac{R_p \times R_O}{R_p + R_O}$$

where R_O is the output resistance of the Signal Generator.

Since the required output resistance is usually the known term, the above expression is more useful when rearranged as follows :-

$$R_p = \frac{R_O \times R_{EO}}{R_O - R_{EO}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Under these conditions, the effective source e.m.f. E_{EFFECT} presented to the load is given by the expression

$$E_{EFFECT} = E \times \frac{R_p}{R_p + R_O} \quad \ldots\ldots\ldots\ldots\ldots (2)$$

where E is the e.m.f. indicated on the attenuator dial.

(c) Source Resistance Greater Than 50 Ohms.

If the required source resistance is greater than 50 ohms, a resistor having a value R_s can be connected in series with the output as shown in figure 4 of TLC 28189. With this arrangement, the effective output resistance, R_{EO}, is given by the expression for resistances in series, e.g.,

$$R_{EO} = R_O + R_s$$

or, more conveniently,

$$R_s = R_{EO} - R_O \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

where R_O is the output impedance of the Signal Generator.

2.5.2 (continued)

For the special case where R_{EO} is equal to 75 ohms, the 50-ohm to 75-ohm Matching Unit Type TM 4918 is available. This unit contains a 25-ohm resistor which, connected in series with the 50-ohm source resistance of the Signal Generator, gives an effective output resistance of 75 ohms.

When the effective output resistance is altered by either of the above methods, the output lead is mismatched at its output end. It is therefore advisable, if the insertion loss can be tolerated, to insert the 20-dB Pad or the 6-dB Pad between the output end of the output lead and the correcting resistor R_p or R_s. The effective source e.m.f. and p.d. across the load, are of course, then reduced by a factor of 20 dB or 6 dB.

(d) Using the Signal Generator with Balanced Loads.

With certain types of equipment, the input circuit is in the form of a balanced winding. Such equipment can be fed from the unbalanced output of the Signal Generator via two correcting resistors as shown in figure 5 of Diagram No. TLC 28189; this arrangement makes use of the auto-transformer effect of the centre-tapped winding to simulate the behaviour of a balanced source. One resistor, R_{s1}. is connected in series between the earthed screen of the output accessory in use and one side of the balanced winding, and a second resistor, R_{s2}, is connected in series with the 'live' output connection and the other side of the balanced winding.

The values of the two resistors, R_{s1}, and R_{s2}, can be calculated from the following expressions :

$$R_{s1} = \frac{R_{EO}}{2}$$

$$R_{s2} = \frac{R_{EO}}{2} \cdot - R_O \quad \ldots\ldots\ldots\ldots (4)$$

where R_{EO} is the required line-to-line output resistance of the Signal Generator.

R_O is the source resistance of the Signal Generator (50 ohms).

2.5.2 (continued)

The 50-ohm to 300-ohm Unbalanced-to-Balanced Transformer type TM 4916 operates on the principle described above.

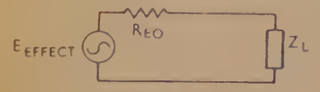
When feeding balanced loads by the method described above, it is advisable, if the insertion loss can be tolerated, also to include the 20-dB Pad or the 6-dB Pad. The effective source e.m.f. is, of course, then reduced by a factor of 20 dB or 6 dB.

OUTPUT ARRANGEMENT DIAGRAMS

E IS THE E.M.F. INDICATED ON THE ATTENUATOR DIAL
R_O IS THE OUTPUT RESISTANCE OF THE GENERATOR = 50 OHMS
V_L IS THE P.D. ACROSS THE LOAD
Z_L IS THE LOAD IMPEDANCE

FIGURE 1 OUTPUT CONDITIONS FOR DIRECT COUPLING

OUTPUT CIRCUIT WITH 6-dB OR 20-dB PAD IN USE



THIS IS EQUIVALENT TO —

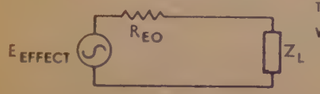
WHERE $E_{EFFECT} = \frac{E}{2}$ FOR 6-dB PAD

OR $\frac{E}{10}$ FOR 20-dB PAD

$R_{EO} = R_O$

FIGURE 2
OUTPUT CONDITIONS FOR COUPLING VIA AN ATTENUATOR PAD

OUTPUT CIRCUIT FOR SOURCE RESISTANCE < 50 OHMS



THIS IS EQUIVALENT TO :—

WHERE $E_{EFFECT} = E \frac{R_P}{R_P + R_O}$

$R_{EO} = \frac{R_P R_O}{R_P + R_O}$

FIGURE 3 OUTPUT CONDITIONS USING PARALLEL RESISTOR

OUTPUT CIRCUIT FOR SOURCE RESISTANCE > 50 OHMS

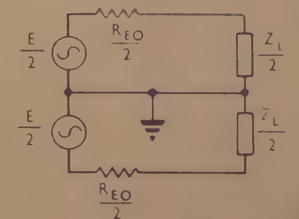
THIS IS EQUIVALENT TO —

WHERE $R_{EO} = R_O + R$

FIGURE 4 OUTPUT CONDITIONS USING SERIES RESISTOR

OUTPUT CIRCUIT FOR BALANCED LINE-TO-LINE SOURCE RESISTANCE < 100 OHMS

WHEN FEEDING INTO BALANCED WINDING THIS IS EQUIVALENT TO —



WHERE R_{EO} = LINE-TO-LINE RESISTANCE

$R_O - R_{S2} = \frac{R_{EO}}{2}$

$R_{S1} = \frac{R_{EO}}{2}$

FIGURE 5
OUTPUT CONDITIONS FOR COUPLING TO BALANCED WINDING

MARCONI INSTRUMENTS LIMITED							
DRN	D.H.	DATE	4.58	CHKD	M.C.	ISSUE	2
STOCK LIST				DRG No.	TLC 28189		

3 OPERATIONAL SUMMARY

When the user is familiar with the principles and techniques of operation detailed in Section 2, the following abridged instructions may be found a convenient guide for quick reference.

Be sure that the power unit is correctly adjusted before switching the instrument on.

TUNING

GENERAL:

Set the main selector switch to C.W.
Set the monitor selector switch to INC. FREQ. 20 kc/s, and adjust the INC. FREQ. control for centre zero on the meter.
Tune the instrument to the desired frequency.

For further details, refer to Section 2.3.1.

CRYSTAL CHECK:

Set the main selector switch to XTAL. CAL. 10 Mc/s or XTAL. CAL. 1 Mc/s.
Plug the high-resistance headphones into the PHONES jack.
Adjust the CAL. GAIN control for a sufficiently loud beat note.
Find the zero-beat point.
Check and align, if necessary, the cursor with the dial calibration just checked.

For further details, refer to Section 2.3.2.

3 (continued)

INCREMENTAL FREQUENCY ADJUSTMENTS:

Set the modulation monitor switch to either INC. FREQ. 20 kc/s or INC. FREQ. 100 kc/s as necessary.
Set up the required shift, using the INC. FREQ. control, and reading this on the MODULATION & INCREMENTAL FREQUENCY meter.

NOTE: due regard must be given to the effects of hysteresis in the modulator reactor.

For further details refer to Sections 2.3.3. and 2.3.4.

SETTING UP FOR C.W. OR MODULATED OUTPUT

C.W.: Set the modulation selector to C.W.
Adjust the SET CARRIER control to bring the CARRIER LEVEL meter pointer to the SET CARRIER mark.

For further details, refer to Section 2.4.1.

FREQUENCY MODULATION

Internal: Set the main selector switch to INT. F.M. 1 kc/s or INT. F.M. 10 kc/s as required.
Set the monitor selector switch to either MOD. 0-150 kc/s or MOD. 0-300 kc/s, as necessary.
Set the deviation by means of the SET MODULATION control, and read the deviation on the MODULATION & INCREMENTAL FREQUENCY meter.

For further details, refer to section 2.4.3.(A).

3 (continued)

External:

Set the main selector switch to EXT. F.M.
Connect the external l.f. source to the EXT. MOD. F.M. socket.
Set the monitor selector switch to MOD. 0-150 or MOD. 0-300, as necessary.
Set the deviation by means of the SET MODULATION control, and read the deviation on the MODULATION & INCREMENTAL FREQUENCY meter.

For further details, refer to Section 2.4.3.(B).

Limited External:

Set the main selector switch to LTD. EXT. F.M.
Connect the external l.f. signal source to the EXT. MOD. F.M. socket.
Set the monitor selector switch to MOD. 0-150 or MOD. 0-300, as necessary.
Set the deviation by means of the SET MODULATION control, and read the deviation on the MODULATION & INCREMENTAL FREQUENCY meter.

For further details, refer to Section 2.4.3.(C).

SETTING THE R.F. OUTPUT LEVEL

ATTENUATOR DIAL:

Adjust the ATTENUATOR control to produce a dial indication, of the required voltage across the 50-ohm load, or of the required level in dB relative to 1 mW in 50 Ω.

For further details, refer to Section 2.5.

4 TECHNICAL DESCRIPTION

4.1 THE R.F. UNIT

Generating at the output frequency without the use of multipliers, the r.f. oscillator employs a disk-seal triode (V12) in a form of shunt-fed Colpitts circuit. The split-stator tuning capacitor (C79) is specially designed to have a low residual inductance. The stator plates are triangular, and the two stator sections are arranged to mesh with a single set of rotor plates. The two stator sections are linked by the flat-strip tuning inductor which is screwed to them.

The tuning capacitor rotor is coupled mechanically to the main tuning dial by means of a one-to-one gear train, and to the tuning control on the front panel by means of a 55:1 reduction gear. The gear system is spring-loaded throughout to reduce backlash to a minimum.

The level of output from the r.f. oscillator is monitored by a silicon diode voltmeter (MR11 and M2), which is inductively coupled to the oscillatory circuit. When the Signal Generator is in use, the oscillator output is set up to a reference level - indicated by a calibration mark on the meter scale - by means of the SET CARRIER control (RV9), which varies the oscillator h.t. voltage.

The piston attenuator is of the mutual-inductance type, and its pick-up element is fitted with a resistance-capacitance network which keeps the output impedance sensibly constant at 50 ohms over the frequency band. The attenuator is coupled to its indicator dial by a rack-and-pinion drive mechanism. Like the main tuning drive, the attenuator drive mechanism is spring loaded to reduce backlash. The front-panel control operates through a friction slow-motion drive.

4.2 MODULATION

The internal a.f. modulating signal is derived from a Wien bridge oscillator utilizing a double triode, V4. The oscillator output amplitude is kept constant by thermistor TH2; thermistor TH3 provides temperature compensation for the output. The a.f. output from the modulation oscillator is taken to the r.f. oscillator driver valve V9, via variable potentiometer RV1b and cathode follower V6.

4.2 (continued)

When the instrument is switched for normal external modulation, the frequency- and amplitude-determining components of the Wien bridge oscillator are switched out of circuit, and V4 is used as a two-stage amplifier; output level from the amplifier arrangement of V4 can be adjusted by means of RV1a.

When the instrument is switched for 'limited external f.m.', the amplifier arrangement of V4 is used, but the thermistors TH2 and TH3 are switched into circuit; TH2 acts as the amplitude-limiting device, since it alters the feedback to V4a from V4b, and TH3 acts as the temperature compensator. The amplifier output level is, in this case, adjusted by means of potentiometer RV1b.

Frequency modulation is effected by the use of a ferrite reactor (T3). In this type of modulator, the effective inductance of a small r.f. coil is varied by permeability changes in its ferrite core. This core also completes the magnetic circuit of an l.f. inductor whose winding carries the a.f. modulating current. The ferrite core is magnetically biased to a linear part above the 'knee' of its B/H characteristic, so that the variations in the magnetic field strength due to the modulating current cause linear corresponding changes in the permeability of the ferrite core, with minimum hysteresis effect.

The a.f. modulating current is fed to the l.f. winding of the modulator via a pentode driver valve, V9.

For a deviation which is constant with change in r.f. carrier frequency, the required level of a.f. drive to the modulator decreases as the carrier frequency is increased. It is, of course, important that a particular deviation should remain constant as changes in carrier frequency are made. This is achieved by a variable potentiometer (RV7) which is included in the input circuit of the reactor driver valve, and is ganged to the main tuning control.

4.3 THE INCREMENTAL FREQUENCY CONTROL

Incremental frequency control is achieved, in the same way as frequency modulation, by means of the ferrite reactor; shift is produced by varying the level of a d.c. voltage applied to the correcting network in the grid circuit of the reactor driver valve. Variable potentiometer RV4 forms the INC. FREQ. control.

4.3 (continued)

The shift voltage is monitored on the MODULATION & INCREMENTAL FREQUENCY meter M1, whose, two incremental scales are calibrated directly in kc/s of frequency shift.

4.4 THE MOD. & INC. FREQ. MONITOR

The MODULATION & INCREMENTAL FREQUENCY meter is used in conjunction with the four-position monitor selector switch, SC, which selects the function and range of the meter. Two ranges are available for both deviation and incremental shift, namely, 0-150 kc/s and 0-300 kc/s deviation, and 20-0-20 and 100-0-100 kc/s of shift, with a different meter scale for each range.

When the meter is used for monitoring the incremental shift, it acts as a simple d.c. voltmeter connected between the slider of the incremental frequency control and chassis.

When f.m. deviation is being monitored, the a.f. output from the cathode follower, V6, as well as passing to the input circuit of the reactor driver valve V9, is fed to the input of a further cathode follower, V7b. The meter is connected via a voltage-doubling rectifier (MR10 and MR12) to the output of this cathode follower. The voltage-doubler arrangement gives an improved meter-scale linearity and better sensitivity than a single diode detector; the monitor reads half of the peak-to-peak value of the a.f. waveform.

4.5 THE CRYSTAL CALIBRATOR

The crystal calibrator has two oscillators, operating at 10 Mc/s and 1 Mc/s respectively, both oscillators being frequency-controlled by a single-frequency crystal.

The 10-Mc/s oscillator, incorporating V8, is directly crystal-controlled by XL1. The 1-Mc/s oscillator, incorporating V10, is a tuned-anode type, with transformer-coupled feedback. A signal from the 10-Mc/s oscillator is injected into the input of V10, and this oscillator locks onto every tenth cycle of the 10-Mc/s signal;

4.5 (continued)

crystal control of the 1-Mc/s oscillator is thus achieved. The outputs from both ostillators are fed to V11a, which mixes the two outputs and feeds the resultant signal to the grid of V11b. The main r.f. signal is sampled by L20, the calibrator unit probe, which passes the sampled signal to V11b cathode; this valve mixes the two signals, and feeds the resulting signal to the input of an amplifier, V13, whose output feeds a further amplifier, V7a. Output from V7a is taken to the PHONES socket on the front panel.

4.6 THE POWER UNIT

The mains transformer (T1), has a primary winding composed of two tapped sections. These sections can be connected in series or parallel to facilitate the operation of the instrument from a selection of supply voltages in the ranges 100 to 150 volts and 200 to 250 volts a.c. Details of the methods of adjusting the power unit to suit different supply voltages at mains frequencies of 40 to 500 c/s are given in Section 5.

The main h.t. supply is derived via a full-wave silicon-diode bridge MR1 to MR4 and a low-impedance series-stabilizer circuit incorporating valves V1 and V2 with a reference potential controlled by the gas-filled reference tube V5.

A negative reference voltage for the incremental frequency control is obtained via a full-wave silicon-diode bridge (MR5 to MR8) and a simple stabilizer circuit (incorporating V3).

The heater supply for the r.f. oscillator and reactor-driver valves is derived via a series stabilizer circuit utilizing transistors. The arrangement is slightly different from the normal series-stabilizer circuit, and a description of the principle of operation is given below.

A change in the 6.3-volt line at R18 is fed to the emitter of d.c. amplifier VT1, whose base is held at a reference potential derived via RV3 from the stabilized h.t. line. The amplified change from VT1 is fed to the base of VT3, an emitter-follower, and from this transistor to the bases of the paralleled pair of transistors, VT2 and VT4, which form the series circuit-element. The voltage drop

4.6 (continued)

The heater supplies for the remainder of the valves in the instrument are obtained directly from a winding (LT1) on the mains transformer.

There are cartridge fuses in the mains transformer input, the h.t. line, the negative line, and the regulated heater circuit; in the crystal calibrator heater circuit, there is a simple soldered fine-wire link on the printed-circuit board.

MAINTENANCE

.1 GENERAL

Section 4 of this handbook describes the internal circuits of the Signal Generator, and is intended to be read in conjunction with the Functional and Circuit Diagrams, which are included at the end of the handbook. It is recommended that, before commencing the adjustment or replacement of component parts of the instrument, the user should familiarize himself with the circuits and principles involved.

All the components on the Circuit Diagram are detailed in the Component List which accompanies it. Components in the list can be located on the diagram easily, since they are given grid references corresponding to the vertical and horizontal divisions around the edge of the diagram .

.2 REPLACEMENT OF FUSES

The mains input circuits of the TF 1066B/2 are protected by 2-amp fuses in each of the supply input lines. These fuses are located on the front panel of the instrument, and are the two lower ones. There is a 100-mA fuse in the negative d.c. rectifier input, and a 250-mA fuse in the main d.c. h.t. rectifier input; these two fuses are also mounted on the front panel. There are two fuses in the regulated l.t. circuit rectifier input - one in each leg. These fuses are located in clips at the bottom of the vertical l.f. and power unit chassis, near the l.t. regulator transistors.

In the crystal calibrator circuit there is a simple soldered fine-wire safety link in the heater supply input; this link protects the thin copper foil of the heater circuits on the printed board. In the unlikely event of failure of this link, removal of the crystal calibrator unit would be necessary; the link is connected between two lugs on the underside of the printed board, close to one corner.

.3 REMOVAL OF COVERS

.3.1 Removing the Case (TF 1066B/2)

(1) Lay the instrument on its face.

(2) Remove the four countersunk screws holding the four metal-domed feet to the back of the case.

(3) Lift the case off, allowing the mains lead to run through the aperture in the right-hand case-handle recess.

.3.2 Removing the Dust Cover (TF 1066B/3)

NOTE: before removing or replacing the dust cover, always check that the attenuator is turned well towards maximum output; this precaution is necessary because the dust cover fits close in to the frame of the instrument, and when the attenuator is turned to lower outputs, the end of the piston-drive rack protrudes through a hole in the right-hand side of the dust cover.

To remove the dust cover, simply unscrew and remove the three screws on the back of the instrument, then slide the dust cover straight off.

.3.3 Removing the Crystal Calibrator Covers

The crystal calibrator fabricated-sheet box has removable top and bottom plates. Its bottom plate also forms the top plate of the r.f. box. The thick wire pick-up probe from the calibrator protrudes through this common plate into the r.f. box.

A To remove the top cover :-

(1) Loosen the fourteen screws around the edge of the top plate - there is no need to remove these screws.

(2) Slide the four slotted strips out from under the screw heads. This exposes holes in the plate large enough to allow the plate with its fine gauze r.f. gasket to be lifted off without removing the screws.

5.3.3 (continued)

B To remove the bottom cover :-

(1) Loosen the sixteen screws around the edge of the r.f.-box top plate, which forms the bottom plate of the crystal calibrator box.

(2) Slide the four slotted strips out from under the screw heads.

(3) Lift the crystal calibrator unit off the r.f. box, being very careful not to bend the probe, which is about three inches long and protrudes vertically downwards. There should be sufficient free length to all the connecting leads between the calibrator unit and the main part of the instrument to allow the calibrator unit to be removed without trouble - if there is not enough free length to the leads, it may be necessary to unsolder some or all of them.

(4) Now unscrew and remove the three screws and nuts holding the calibrator box to the bottom plate. There is a gauze r.f. gasket between the plate and the calibrator box.

5.3.4 Removing the R.F. Unit Covers

The cast r.f. box has three sheet metal cover plates, one of which is formed by the bottom plate of the crystal calibrator unit as described above. The other two plates are at the rear and on the bottom of the r.f. unit. Each plate is secured to the casting with sixteen screws and four slotted retaining strips.

5.4 LOCATION OF COMPONENTS

The instrument is assumed to be upright, in its normal working position.

5.4.1 Power Unit Components

All the power unit components are on the large vertical chassis. The mains transformer is at the top, as are the main h.t. regulator valves V1, V2, and V5, and the negative-line stabilizer valve V3.

5.4.1 (continued)

The main h.t. and negative-line rectifiers MR1 to MR4 and MR6 to MR9 are arranged in a row on two tagstrips below the mains transformer. The regulated-l.t. rectifier MR5 is mounted at the bottom of the chassis, with the rest of the regulated-l.t. components and the two fuses FS4 and FS5.

The main-h.t. adjustment potentiometer RV2, is at the top of the chassis, near the mains transformer. RV3, the regulated-l.t. adjustment potentiometer, is mounted at the bottom left-hand corner of the chassis.

5.4.2 L.F. Components

The chassis which supports the power unit components also supports the modulation a.f. oscillator and amplifier components, and the modulation-reactor driver valve and its associated components.

The reactor driver valve is below V1, and level with the tagstrips holding the h.t. rectifiers. Valves V4 and V6 are in the centre section of the chassis. V7 is in the bottom right-hand corner of the chassis.

The CARRIER LEVEL monitor meter sensitivity adjustment potentiometer RV11, is at the top of the chassis. The deviation monitor circuit adjustment potentiometer, RV5, is at the bottom of the chassis, in the right-hand corner.

5.4.3 R.F. Unit Components

The disk-seal triode and its associated components, and the f.m. reactor, are all contained inside the r.f. box, and the supplies input r.f. filters protrude through the walls of the casting. The filter directly above the piston attenuator carries the heater supply for the triode. The filter directly below the attenuator carries the h.t. supply to the triode. Of the two filters on the rear edge of the r.f. casting, the top filter is the three-stage input filter to the f.m. reactor, and the filter below it is the one connecting the reactor to the h.t. side of R69.

The output monitor filter unit, which is mounted on the attenuator flange, contains the silicon diode MR11; this diode can be removed easily after the connection to the top cap of the filter case has been unsoldered and the complete cylindrical body has been screwed off.

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.4.3 (continued)

The two potentiometers used for setting up the internal f.m. tracking (RV6 and RV8) are of the miniature type, and are mounted on a bracket on the side of the r.f. -unit casting, above the piston attenuator.

The Disk-seal Triode

The disk-seal triode inside the r.f. box is mounted near the input end of the piston attenuator; to remove the triode proceed as follows :-

(1) Remove the crystal Calibrator complete with the r.f. box top plate, and remove the bottom plate from the r.f. box.

(2) Place the instrument on its left-hand side.

(3) Using the special pliers which are normally clamped to the outer or left-hand end of the r.f. box casting, remove the circlip which retains the anode flange - this circlip is accessible from the bottom of the r.f. box.

(4) Pull the central heater connection off its pin - the heater and cathode connections are accessible through the top opening of the r.f. box.

(5) Holding the cathode connector firmly (it is joined to a rigid tubular trimmer capacitor), pull the triode out through its grid and anode contact rings and out of the bottom opening in the r.f. box. There is an annular ring of metal gauze which fits over the anode flange of the valve.

.4.4 Crystal Calibrator Unit Components

All components of the crystal calibrator except its output valve (V7a) are contained within the screened calibrator box mounted on the top plate of the r.f. box. The 10-Mc/s crystal, the trimmer capacitors C37 and C50, and all the valves except V7 are accessible after removal of the top plate of the calibrator unit - for removal, see Section 5.3.3. C50 is also accessible without removing the top plate, by simply levering off the small domed plug button near the corner of the plate.

.4.4 (continued)

V11 and V13 are the two valves nearer the front panel, and V8 and V10 are nearer the rear of the instrument. V8 is close to the 10-Mc/s crystal. C37 is next to the crystal. The 1-Mc/s oscillator transformer, T2, is next to C50, which is in a corner of the printed board.

.5 MAINS INPUT ARRANGEMENTS

The mains transformer has a double-wound primary with arrangements for connection of the two tapped sections in series for the 200- to 250-volt range, or in parallel for the 100- to 150-volt range. The instrument is normally despatched with its power unit set for operation from a 240-volt mains supply. It can be adjusted for operation from other supplies at mains frequencies between 40 and 500 c/s by following the instructions given below.

The arrangements of the connections to the input of the mains transformer are shown diagrammatically on Drawing No. TLC 28392 which follows this page.

The input voltage tappings are made by means of soldered connections to tags on the transformer winding. To reach the transformer, it is necessary to remove the case from the instrument - see Sections 5.3.1 and 5.3.2.

The two sections of the double-wound primary are connected together by linking the appropriate tags as in 'A' on the diagram. To change from one major voltage range to another, alter the linking on the transformer as shown.

Selection of intermediate voltages within the range is made by means of two flying leads soldered to the transformer tags. These tags are common to both ranges, and are therefore each marked with two voltages; the applicable voltage depends on the position of the major range links. One flying lead must always be connected to either the '0' or '+10' tag; the other lead is connected to the tag whose voltage, added to 0 or 10 as appropriate, equals the mains supply voltage. Do not connect either lead to the tags marked TAP A or TAP B.

6 WORKING VOLTAGES

The following voltages, which are intended for guidance when checking the functioning of individual circuits in the instrument, were obtained from a typical TF 1066B/2; the voltmeter employed had an input resistance of 20 kΩ per volt.

6.1 Power Unit Voltages

These measurements were taken with the main seleetor switch set to C. W.

Main h.t. a.c.	across H. T. 1 winding	360 V a. c.
Negative h.t. a.c.	across H. T. 2 winding	265 V a.c.
L. T. 1	across transformer tags	6.4 V a.c.
L. T. 2	across transformer tags	6.4 V a.c.
L. T. 3	across transformer tags	14.1-0-14.1 V a.c.

L. T. Regulator D. C. Voltages

Measurements made with respect to earth

L. T. 3 centre tap	-8 V
R2/R12 junction	-7 V
VT2 emitter	-0. 8 V
VT4 emitter	-0. 9 V
VT2/VT4 collectors	-5. 9 V
VT2/VT4 bases	-1. 4 V

6.2 Valve Electrode Voltages

Valve No.	Main Selector Switch Position	d. c. voltages Anode	Screen	Cathode	Grid
V1	C. W.	450	450	280	250
V2	C. W.	250	120	86	85
V3	C. W.	0	-	-108	-
V4a	INT. F. M. 1 kc/s	210	-	5	0
V4b	INT. F. M. 1 kc/s	190	-	1.7	-0. 6
V5	C. W.	85	-	0	-

.6.2 (continued)

Valve No.	Main Selector Switch position	d.c. voltages Anode	Screen	Cathode	Grid
V6	INT. F.M. 1 kc/s	280	280	150	89
V7a	XTAL CAL.	175	-	1.7	0
V7b	C.W.	275	-	72	0.07
V8	XTAL CAL.	210	120	40	4
V9	C.W.	280	280	11	0
V10	XTAL CAL.	235	235	0	-6.5
V11a	XTAL CAL.	87	-	1	-0.4
V11b	XTAL CAL.	108	-	0.6	-2
V12	C.W.	270 max	-	0	-
V13	XTAL CAL.	195	170	3.4	0

.7 ADJUSTMENT OF PRESET CONTROLS

Before adjustments are made to any preset controls, the instrument should, after switching on, be allowed to warm up throughly.

.7.1 Power Supplies - RV2, RV3

Check the d.c. h.t. voltage (at pin 3 of V1, for example), and adjust RV2 if necessary, to give a reading of approximately 280 volts; this might need to be adjusted to a slightly different voltage when setting the INC. FREQ. meter zero (see Section 5.7.2).

Check the d.c. l.t. voltage, and if necessary, adjust RV3 to give a reading of 6.3 volts.

.7.2 Setting the INC. FREQ. Meter Central Zero - RV2, RV4

(1) Set the main selector switch to C.W., and the monitor selector switch to INC. FREQ. 20 kc/s.

(2) Short-circuit V9 grid to earth.

.7.2 (continued)

(3) Now adjust RV2 if necessary, so that the MODULATION & INCREMENTAL FREQUENCY meter pointer reads exactly at its centre zero mark on the lower scales. If RV2 is readjusted, the d.c. l.t. voltage should be re-checked, and RV3 readjusted if necessary - see Section 5.7.1.

(4) Remove the short-circuit from V9 grid, and reconnect RV4 wiper.

(5) Set the INC. FREQ. control for centre zero on the meter, and if necessary, loosen the knob screws and set the pointer on the knob to the centre dot on the front panel.

.7.3 Carrier Level Monitor - RV11

(1) Set the main selector switch to C.W., and set the frequency to 475 Mc/s.

(2) Turn the SET CARRIER control to about three-quarters maximum, and set the attenuator dial for a reading of 100 mV.

(3) Now adjust RV11 so that the CARRIER LEVEL meter reads at the SET CARRIER mark.

(4) Using an accurate valve voltmeter, read the actual output voltage of the instrument. This should be 100 mV, i.e., the same as shown on the attenuator.

(5) If the actual voltage is not 100 mV, adjust the attenuator control to achieve this.

(6) Loosen the two socket screws on the attenuator drive shaft (i.e., the bellows or the drive gear boss), and, making sure the output is still at 100 mV, restrain the rack from moving and rotate the attenuator control until the dial reading is 100 mV. Now tighten the socket screws.

(7) Check the accuracy again, as described above.

.7.4 F.M. and Incremental Frequency Accuracy and Tracking - RV5, RV6, and RV8

Since the incremental-frequency and internal-f.m. accuracies and tracking are to a fair extent interdependent, it follows that adjustments to one will necessitate adjustments to the other. The sequence of the following sub-sections should, therefore, always be adhered to when adjustments are carried out.

.7.4.1 Incremental Frequency, Initial Setting - RV6

In the Works method of checking and adjusting the incremental-frequency accuracy of the TF 1066B/2, the instrument is tuned to one carrier frequency, and is heterodyned with an independent stable signal generator to produce an i.f. of 20 Mc/s. This signal is heterodyned with a further independent signal to produce an exact zero beat. The frequency of the TF 1066B/2 is then shifted by the amount to be checked, and this shift is reproduced at the output of the second mixer arrangement. This l.f. signal is compared with the output from an accurate l.f. generator, using the Lissajous-figure method on an oscilloscope.

The Works method involves the use, as the second local oscillator/mixer, of a Marconi Carrier Deviation Meter Type TF 928 which has been modified so that its i.f. output is available at the front panel; this arrangement utilizes the instrument's local oscillator and mixer and its wide-band i.f. amplifier. Any alternative frequency-changer/amplifier arrangement whose local oscillator will work at about 20 Mc/s will most probably be suitable.

(1) Set the main selector switch on the TF 1066B/2 to C.W., and tune to 400 Mc/s, then set the carrier level.

(2) Set the monitor switch to INC. FREQ. 100 kc/s, and centralize the INC. FREQ. control, after sweeping to maximum shift and then slowly back to zero to neutralize hysteresis.

(3) Tune an independent signal generator to either 380 Mc/s or 420 Mc/s.

.4.1 (continued)

(4) Feed the outputs from the two generators into a suitable mixer, and feed the resulting 20-Mc/s output from the mixer to the input of the modified deviation meter or alternative arrangement.

(5) Connect the i.f. output of the deviation meter to the Y-amplifier input of an oscilloscope.

(6) Connect an l.f. oscillator, tuned accurately to 100 kc/s, to the X-deflection system of the oscilloscope.

(7) Tune the deviation meter until the local oscillator beats with the incoming 20-Mc/s signal, i.e., until the Y deflection on the oscilloscope disappears.

(8) Adjust the INC. FREQ. control on the TF 1066B/2 so that the monitor meter indicates 100 kc/s.

(9) Adjust RV6 for a reading of 100 kc/s on the external indicator i.e., for a stationary circle or ellipse on the oscilloscope.

It may be necessary to readjust the INC. FREQ. control again slightly, and afterwards RV6 again, to make the incremental-frequency monitor and the external monitor agree.

.4.2 Modulation Monitor Accuracy - RV5

(1) Leaving the TF 1066B/2 tuned to 400 Mc/s, set the main selector switch to INT. F.M. 10 kc/s.

(2) Disconnect the output from the i.f. of the deviation meter - the instrument is used in its normal function for this test.

(3) Adjust the SET MODULATION control on the TF 1066B/2 for a reading of exactly 300 kc/s on the external deviation meter.

(4) Adjust RV5 until the Signal Generator's deviation monitor meter reads exactly 300kc/s.

.7.4.3 F.M. Tracking - RV6, RV8

Once the internal monitor accuracy has been correctly adjusted at a point where the incremental-frequency accuracy is good, either the internal f.m. or the incremental-frequency accuracy can be tracked over the frequency range of the instrument - if one facility is tracked, then the other will automatically be correct. For convenience, the internal f.m. is tracked.

(1) With the arrangements exactly as set up in the preceding sub-section, tune the TF 1066B/2 to various frequencies throughout its range, adjusting potentiometers RV6 and RV8 to keep the deviation as near constant as possible. RV6 affects the deviation over the whole of the r.f. range, whereas RV8 affects mostly the higher-frequency end of the range.

Make sure that the SET MODULATION control is not too near its 'maximum' position.

.7.5 Crystal Calibrator Frequencies - C37, C50

(1) Set the main selector switch to XTAL. CAL. 1 Mc/s and allow the calibrator unit time to warm up.

(2) Remove the top plate of the calibrator box as described in Section 5.3.3, and connect the input of an accurate frequency-measuring device to the grid of V11a; although the printed circuit is on the underside of the board, the grid of this valve can probably be contacted where the valveholder contacts disappear through the top of the printed board, or the appropriate wire lead of either C51, C52, or R53 can be contacted where it is fed through the board. These three components are quite close to V11.

(3) Set the main selector switch to XTAL CAL. 10 Mc/s.

(4) Using the trimming tool provided (normally clipped to the top left-hand side of the l.f. chassis, near the crystal calibrator unit), adjust C37 until the frequency of the 10-Mc/s oscillator is of the required accuracy.

.7.5 (continued)

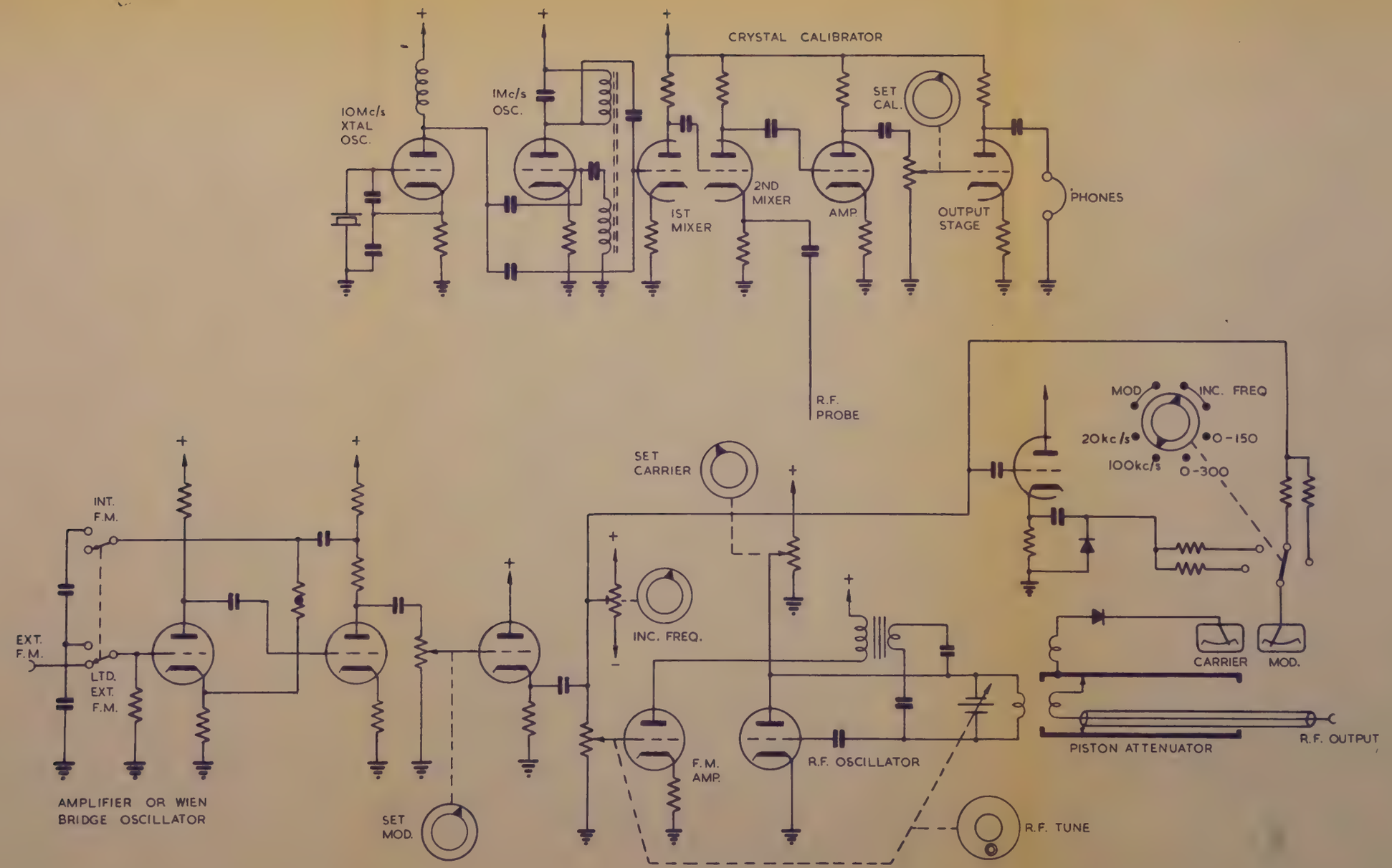
(5) Set the selector switch to XTAL CAL. 1 Mc/s, and remove the connection to the frequency-measuring apparatus.

(6) Plug a pair of high-resistance headphones into the PHONES jack on the front panel.

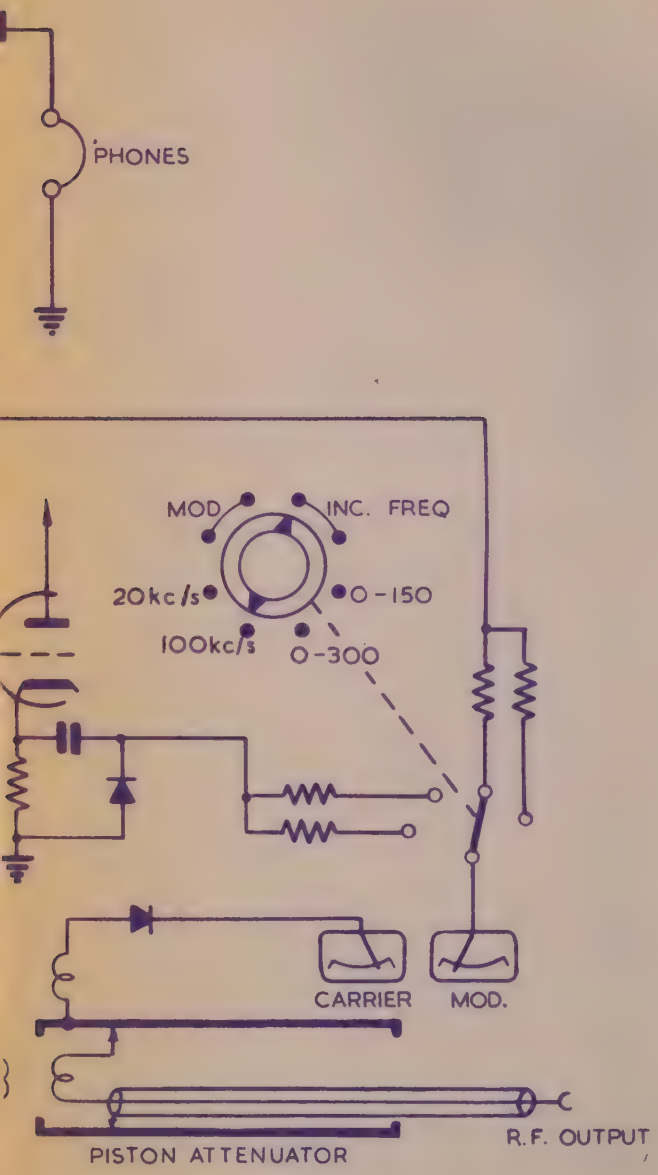
(7) Tune the instrument to a frequency where the r.f. signal does not beat with the crystal-oscillator signal.

(8) Now adjust C50 until the two oscillators heterodyne together; the zero-frequency point must be located as closely as possible. This can best be done by tuning the 1-Mc/s oscillator right through the null point once or twice; as the null is approached, the beat-note frequency will drop quite rapidly due to the 10-Mc/s oscillator 'pulling' the frequency of the 1-Mc/s oscillator. On tuning through the null portion, as the two frequencies diverge, the 10-Mc/s oscillator will relax its effect on the 1-Mc/s oscillator frequency quite quickly, and the audible beat note will then start to rise steadily. The trimmer C50 should be adjusted to a point halfway between the two positions where the frequency 'pulling' begins.
NOTE: since the coverage of C50 is quite small, it may also be necessary to adjust the core of inductor T2.

As a check, tune the instrument to any 1-Mc/s calibration point, and listen for the beat of the carrier signal with the 1-Mc/s calibrator signal; the null point should be clearly defined. If at any single 1-Mc/s point there are several indefinite null points, this is an indication that the 1-Mc/s oscillator is not locked to the 10-Mc/s oscillator, and it will be necessary to repeat steps (7) and (8).



FUNCTIONAL DIAGRAM OF F.M. SIGNAL GENERATOR TYPE TF1066B/2


PHONES
MOD
INC. FREQ
20kc/s
0-150
100kc/s
0-300
CARRIER
MOD.
PISTON ATTENUATOR
R.F. OUTPUT

R.F. TUNE

ISSUE NO. 6

CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.	CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.
	RESISTORS			R27	1·5Ω ± 10% ½W	F8	14. TM 6472
R1	10Ω ± 10% ½W	D5	115 TF1066B/2&/3	R28	1KΩ ± 10% ½W	F11	5. TM 6471
R2	1Ω ± 10% 5W	D7	20. TM 6472	R29	1·5Ω ± 10% ½W	F7	14. TM 6472
R3	220Ω ± 10% ½W	D9	6. TM 6486	R30	10KΩ ± 10% 1W	F9	15. TM 6472
R4	22Ω ± 10% ½W	D5	7. TM 6486	R31	2·2KΩ ± 10% ½W	F10	43. TM 6471
R5	10KΩ ± 5% 4½W	D9	25. TM 6471	R32	220Ω ± 10% ½W	F12	44. TM 6471
R6	1KΩ ± 10% 1½W	D4	31 TM 6471	R33	1·5KΩ ± 10% ½W	F7	45. TM 6471
R7	1KΩ ± 10% ½W	E6	12. TM 6472	R34	220KΩ ± 10% ½W	G12	6. TM 6472
R8	100Ω ± 10% ½W	E4	27. TM 6471	R35	43KΩ ± 5% ½W	G9	114. TF1066B/2/3
R9	4·7KΩ ± 10% ½W	E4	28. TM 6471	R36	100Ω ± 10% ½W	G11	27. TM 6471
R10	680KΩ ± 10% ½W	E4	29. TM 6471	R37	43KΩ ± 5% ½W	G9	114. TF1066B/2/3
R11	330KΩ ± 10% ½W	E4	30. TM 6471	R38	3·3Ω ± 10% ½W	G12	48. TM 6471
R12	1Ω ± 10% 5W	E7	20 TM 6472	R39	6·8KΩ ± 5% 1½W	G12	17. TM 6472
R13	2·7KΩ ± 5% 4½W	E9	8. TM 6486	R40	47Ω ± 10% ½W	G11	30. TM 6471
R14	100KΩ ± 1% ½W	E12	32. TM 6471	R41	100Ω ± 10% ½W	G11	27. TM 6471
R15	100KΩ ± 1% ½W	E10	15. TM 6472	R42	56KΩ ± 10% ½W	H10	116 TF1066B/2&/3
R16	10KΩ ± 10% ½W	E11	33. TM 6471	R43	56KΩ ± 5% ½W	H11	9. TM 6472
R17	47KΩ ± 10% ½W	E5	34. TM 6471	R44	15KΩ ± 5% ½W	H11	50. TM 6471
R18	27Ω ± 10% ½W	E6	10. TM 6472	R45	1KΩ ± 10% ½W	J4	7. TM 6472
R19	100KΩ ± 10% ½W	E11	17. TM 6472	R46	4·7KΩ ± 10% ½W	J12	28. TM 6471
R20	4·7KΩ ± 10% ½W	E12	28 TM 6471	R47	1MΩ ± 10% ½W	H12	8. TM 6486
R21	100KΩ ± 10% ½W	E4	38. TM 6471	R48	47KΩ ± 10% ½W	J6	9. TM 6472
R22	100KΩ ± 10% ½W	E12	36. TM 6471	R49	47Ω ± 10% ½W	J7	9. TM 6472
R23	470KΩ ± 10% ½W	E12	53. TM 6471	R50	33KΩ ± 10% ½W	J7	10. TM 6472
R24	100KΩ ± 10% ½W	F4	36. TM 6471	R51	10KΩ ± 10% ½W	J6	11. TM 6472
R25	33KΩ ± 10% ½W	F5	39. TM 6471	R52	10KΩ ± 10% ½W	J7	11 TM 6472
R26	39KΩ ± 10% ½W	F6	11. TM 6472	R53	470Ω ± 10% ½W	J12	54. TM 6471

DRAWN S. FILDES	CHKD	USED ON TF1066B/2 & /3	COMPONENT LIST XE 34134
DATE 9.11.60.	APPD.	SHT. 1 OF 2 SHTS.	
TRACED MS.	MARCONI INSTRUMENTS LTD.		

12 NOV 1962
MARCONI
INST. LTD.

ISSUE NO.

CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.	CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.
R54	22KΩ ± 10% ½W	J12	7. TM 6472	R81	10KΩ ± 10% ¼W	N12	34. TM 6472
R55	22KΩ ± 10% ½W	J9	13. TM 6517	R82	130KΩ ± 10% ¼W	N7	20. TM 6517
R56	3·3KΩ ± 2% ½W	J11	103TF1066B/2	R83	250KΩ ± 10% ¼W	N6	18. TM 6517
R57	100K ± 10% ½W S.I.C.	J7	14. TM 6517	R84	1MΩ ± 10% ¼W	P7	21. TM 6517
R58	4·7KΩ ± 10% ½W	J7	11. TM 6517	R85	100KΩ ± 10% ¼W	P6	14. TM 6517
R59	100KΩ ± 2% ½W	K11	110TF1066B/2	R86	3·3KΩ ± 10% ½W	P7	20. TM 6517
R60	4·7KΩ ± 10% ½W	K9	15. TM 6517	R87	10KΩ ± 10% ½W	P11	34. TM 6472
R61	9·6MΩ ± 2% ½W	K10	111TF1066B/2	R88	100Ω ± 10% ¾W S.I.C.	P10	23. TM 6472
R62	14KΩ ± 2% ½W	K10	106TF1066B/2	R89	50Ω ± 2% ¼W S.I.C.	P11	19. TM 6472
R63	10MΩ ± 20% ½W	K9	114TF1066B/2	R90	50Ω ± 2% ¼W S.I.C.	Q11	19. TM 6472
R64	56KΩ ± 2% ½W	K10	113TF1066B/2	R91	220K ± 10% ½W	Q6	6. TM 6472
R65	5·8KΩ ± 10% ½W	K12	73. TM 6479	R92	3·3KΩ ± 10% ½W	Q7	20. TM 6517
R66	4·7KΩ ± 10% ½W	K5	16. TM 6517	R93	1·2KΩ ± 10% ½W	Q12	34. TM 6472
R67	22KΩ ± 10% ½W	K6	13. TM 6517	R94	68KΩ ± 5% 2W	F6	13. TM 6472
R68	22KΩ ± 10% ½W	K5	13. TM 6517				
R69	47KΩ ± 10% ½W S.I.C.	L10	24. TM 6471				
R70	10KΩ ± 10% ½W S.I.C.	L7	11. TM 6517				
R71	820Ω ± 10% ½W	L12	50. TM 6471				
R72	10KΩ ± 10% 1W	L12	107. TF1066B/2				
R73	220KΩ ± 10% ¼W	M7	10. TM 6517				
R74	150Ω ± 10% ½W	M7	17. TM 6517		RESIST. VAR.		
R75	68KΩ ± 10% ½W	M5	18. TM 6517	RV1A RV1B	100KΩ ± 100KΩ ± 20% 1W	D12 F13	1 TF1066B/2
R76	68KΩ ± 10% ½W	M5	18. TM 6517	RV2	50KΩ ± 10% 1W	F4	83. TM 6471
R77	220KΩ ± 10% ½W	M7	10. TM 6517	RV3	500Ω ± 10% 1W	F6	16. TM 6517
R78	4·7KΩ ± 10% ½W	M6	6. TM 6517	RV4	50KΩ ± 10% 1W	G7	109TF1066B/2
R79	4·7KΩ ± 10% ½W	M6	6. TM 6517	RV5	15KΩ ± 10% 1W	K11	69. TM 6471
R80	100Ω ± 10% ½W	N7	19. TM 6517	RV6	15KΩ ± 20% ½W	K11	72. TM 6471

DRAWN G FILDES.	CHKD —	USED ON TF1066B/2 & /3	COMPONENT LIST XE34134
DATE 9.11.60.	APPD.	SHT. 2 OF 7 SHTS.	
TRACED MS	MARCONI INSTRUMENTS LTD.		

12 NOV 1982
MARCONI
INST. LTD.

ISSUE NO. –

CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.	CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.
RV7	5KΩ ± 10% ¼W	K12	76.TM 6470	C19	0·1μF ± 20% 350V	F11	84 TM 6471
RV8	15KΩ ± 20% ¼W	K11	77.TM 6470	C20	5300pF ± 10% S.I.C. 125V	F12	83.TM 6471
RV9	20KΩ ± 10% ½W	L11	120.TF1066E/2	C21	8μF −20% +50% 450V	F4	4.TM 6471
RV10	500KΩ ±20% ¼W	Q6	68.TM 6471	C22	1μF ± 20% 350V	F10	3.TM 6471
RV11	5KΩ ± 10% 1W	Q12	69.TM 6471	C23	0·1μF ± 20% 350V	G11	33 TM 6472
				C24	4700pF +INF −0 350V	G4	2.TM 6471
				C25	4700pF +INF −0 350V	H4	3.TM 6003
				C26	4700pF +INF −0 350V	H4	6.TM 6001
	CAPACITORS			C27	4700pF +INF −0 350V	G5	5.TM 6002
C1	0·1μF ± 20% 150V	C6	73.TM 6471	C28	4700pF +INF −0 350V	H5	6.TM 6001
C2	1000μF −20% +50% 25V	D6	74.TM 6471	C29	4700pF +INF −0 350V	H5	6.TM 6001
C3	1000μF −20% +50% 25V	D6	74.TM 6471	C30	4700pF +INF −0 350V	G5	5.TM 6002
C4	1μF ± 20% 250V	D11	123.TF1066E/2	C31	4700pF +INF −0 350V	H5	6.TM 6001
C5	8μF −20% +50% 450V	D8	76.TM 6471	C32	4700pF +INF −0 350V	H5	6.TM 6001
C6	8μF −20% +50% 500V	D5	77.TM 6471	C33	8μF −20% +50% 450V	G12	76.TM 6471
C7	1600pF ± 2% 350V	D11	78.TM 6471	C34	47pF ± 20% 350V S.I.C.	F10	81.TM 6471
C8	1600pF ± 2% 350V	D12	78.TM 6471	C35	0·01μF −20% +80% 350V	H7	20.TM 6471
C9	1000pF −20% +50% 25V	D6	74.TM 6471	C36	0·05μF ± 20% 250V	H11	87.TM 6472
C10	1600pF ± 2% 350V	D11	79.TM 6471	C37	3–30pF 750V	J7	89.TM 6571
C11	1600pF ± 2% 350V	D12	79.TM 6471	C38	500pF ± 5% 125V	J8	90.TM 6471
C12	8μF −20% +50% 450V	E8	76.TM 6471	C39	8μF −20% +50% 450V	J4	91.TM 6471
C13	0·1μF ± 20% 150V	E7	92.TM 6472	C40	5μF ± 20% 150V	J12	85.TM 6471
C14	32μF −20% +50% 500V	E5	80.TM 6471	C41	33pF ± 2% 350V	J6	5.TM 6517
C15	300μF −20% +100% 25V	E6	81.TM 6471	C42	0·01μF −20% +80% 350V	K7	20.TM 6471
C16	180pF ± 10% S.I.C. 25V	E12	72.TM 6471	C43	0·01μF −20% +80% 350V	K8	20.TM 6471
C17	·25μF ± 25% 350V	F3	82.TM 6471	C44	0·01μF −20% +80% 350V	K7	20.TM 6471
C18	4μF −20% +100% 350V	F9	94.TM 6472	C45	0·01μF −20% +80% 350V	K7	20.TM 6471

DRAWN G.FILDES	CHKD	USED ON TF1066E/2 & /3	COMPONENT LIST
DATE 9.11.60.	APPD.	SHT. 3 OF 7 SHTS.	XE34134
TRACED MS	MARCONI INSTRUMENTS LTD.		

13 NOV 1962
MARCONI
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ISSUE NO. -

CIR REF.	DESCRIPTION	GRID	STOCK LIST REF.	CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.
C46	22pF ± 2pF 350V	K7	36. TM 6517	C73	[illegible] SPEC.	M12	TM. [illegible]
C47	4·7pF ± 10% 500V S.I.C.	L8	37. TM 6517	C74	2·2pF ± ·5pF 750V	M11	[illegible] TM [illegible]
C48	100pF ± 2% 350V	L9	38. TM 6517	C75	0·001µF ± 20% 500V	M9	[illegible]
C49	[illegible] pF ± 5% 750V	L7	35. TM 6517	C76	0·01µF − 20% + 50% 350V	M8	26. TM [illegible]
C50	2-8pF 750V	L9	39. TM 6517	C77	0·01µF − 20% + 50% 350V	P7	26. TM 6511
C51	4·7pF ± ·5pF 750V	L6	33. TM 6517	C78	1pF ± ·5pF 750V	N11	30. TM 6[illegible]
C52	0·001µF ± 20% 500V	M6	34. TM 6517	C79	SPECIAL	N10	TM. [illegible]
C53	4700pF + INF. − 0 350V	L10	5. TM 4883	C80	0·01µF − 20% + 80% 350V	P6	26. TM [illegible]
C54	4700pF + INF. − 0	M10	5. TM 4883	C81	[illegible]µF − 20% + 100% 12V	P1	[illegible]
C55	4700pF + INF. − 0 350V	M10	5. TM 4883	C82	500pF ± 5% INF. 350V	P6	5. TM 4883
C56	10pF ± 30% 350V	L10	8. TM 4883J	C83	500pF + INF. − 0 350V	P6	[illegible] TM 4883
C57	[illegible]pF ± 30% 350V	M10	8. TM 4883J	C84	500pF + INF. − 0 350V	P7	[illegible]
C58	10pF ± 30% 350V	M10	8. TM 4883J	C85	0·001µF ± 20% 500V	P	[illegible]
C59	10pF ± 30% 350V	M10	8. TM 4883J	C86	[illegible]pF ± [illegible]% 500V	N10	[illegible]
C60	4700pF + INF. − 0 350V	L11	5. TM 4883	C87	4700pF + INF. − 0 350V	N10	[illegible]
C61	4700pF + INF. − 0 350V	M11	5. TM 4883	C88	4700pF + INF. − 0 350V	N11	[illegible]
C62	4700pF + INF. − 0 350V	M11	5. TM 4883	C89	12pF SPEC.	Q12	TM. 4613/4
C63	4700pF + INF. − 0 350V	L12	5. TM 4883	C90	[illegible]µF − 20% + 100% 12V	Q7	36. TM [illegible]
C64	4700pF + INF. − 0 350V	L12	5. TM 4883	C91	·01µF ± 20% 400V	Q5	29. TM [illegible] 2
C65	4700pF + INF. − 0 350V	M12	5. TM 4883	C92	8µF − 20% + 100% 50V.	J12	128. TF [illegible]
C66	0·01µF − 20% + 80% 350V	M7	28. TM 6517				
C67	0·01µF − 20% + 80% 350V	M7	28. TM 6517				
C68	0·001µF ± 20% 500V	M6	34. TM 6517				
C69	0·001µF ± 20% 500V	N7	34. TM 6517				
C70	0·001µF ± 20% 500V	N7	34. TM 6517				
C71	0·5 − 2pF	N11	78. TM 6[illegible]		INDUCTORS		
C72	0·001µF ± 20% 500V	N7	34. TM 6517	L1	[illegible]	M4	[illegible]

DRAWN G. F[illegible]	CHKD	USED ON [illegible]	COMPONENT LIST
DATE 9.11.60.	APPD.	SHT. 4 OF 7 SHTS.	XE 34134
TRACED MS	MARCONI INSTRUMENTS LTD.		

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CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.	CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.
L2	95µH	H4	1.TM 4883	L29	95µH	[illegible]	[illegible]
L3	95µH	H3	1.TM 4883				
L4	95µH	H5	1.TM 4883				
L5	6µH	H6	1.TM 4883E		TRANSISTORS		
L6	6µH	H6	1.TM 4883E	VT1	GET 114	E6	46.TM [illegible]
L7	3·7µH	J6	43.TM 6517	VT2	CTP 1109	F7	9.TM [illegible]
L8	95µH	L10	1.TM 4883	VT3	GET 115	F7	9.TM [illegible]
L9	95µH	M10	1.TM 4883	VT4	CTP 1109	F7	9.TM [illegible]
L10	95µH	L10	1.TM 4883J				
L11	95µH	L11	1.TM 4883J		SWITCHES		
L12	95µH	M10	1.TM 4883J	SA	ON - OFF	B8	52.TF [illegible]
L13	95µH	L11	1.TM 4883	SBA-D	8 POS'N		60.TF1066B/2
L14	95µH	M11	1.TM 4883	SBE-M	8 POS'N		16.TM 6471
L15	6µH	L12	1.TM 4883E	SC	4 POS'N	K11	61.TF1066B/2
L16	6µH	M12	1.TM 4883E				
L17	1·7µH	M6	44.TM 6517		TRANSFORMERS		
L18	4·5µH	M11	88.TM 6470	T1	MAINS	C3	1.TM 6471
L19	BIFILAR	N12	85.TM 6470	T2	OSC.	L7	TM. [illegible]
L20	SPEC.	N6	61.TM 6517	T3	REACTOR	N10	2.TM [illegible]
L21	SPEC.	P11	11.TM 6503				
L22	SPEC.	P11	17.TM 6503				
L23	SPEC.	P12	15E.TM6470		METERS		
L24		P11	87.TM 6470	M1	100µA	K12	3.TF [illegible]
L25		P11	21.TM4819/4	M2	100µA	K12	4.TF [illegible]
L26	95µH	P6	1.TM 4883F		PILOT LAMPS		
L27	95µH	Q6	1.TM 4883F	PL21		D4	.TF [illegible]
L28	95µH	P10	1.TM 6487				

DRAWN G. FILDES	CHKD	USED ON TF1066B/2 & /3	COMPONENT LIST
DATE 9.11.60.	APPD.	SHT. 5 OF 7 SHTS.	XE34134
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CIR REF	DESCRIPTION	GRID	STOCK LIST REF
	VALVES		
V1	6CD6G	E3	116. TM 6471
V2	6AK5	E4	117. TM 6471
V3	OA2	E8	120. TM 6471
V4	12AU7	E11	121. TM 6471
V5	6B8	E5	122. TM 6471
V6	EBF89	G11	123. TM 6471
V7	PL81	G5 J5	124. TM 6471
V8	6X4	J7	58. TM 6517
V9	EL 84	L11	125. TM 6471
V10	EBF89	K6	56. TM 6517
V11	ECC88	M6	57. TM 6517
V12	12AT7 - 10	N11	12. TM 6501
V13	EBF89	P6	56. TM 6517
	PLUGS		
PL1	MAINS	F8	5. TF 1066E/2
	SOCKETS		
SK1	VOL.	E11	12. TM 6517/4
SK2	VOL.	Q12	83. TF 1066E/2
	JACKS		
J1	PHONES	Q7	84. TF 1066E/2
	RECTIFIERS		

CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF
MR1	2E8	C3	
MR2	2E8	C1	
MR3	2E8		
MR4	2E8	C4	
MR5	S x E91	C7	91.
MR6	2E4	C8	12.
MR7	2E4	C6	
MR8	2E4	C5	
MR9	2E4	C6	
MR10	OG3	J12	117 TF 1066B/24/3
MR11	OS2A	P12	54.
MR12	OS1E	J12	
	CRYSTALS		
XL1	10Mc/s	H7	93.
	FUSES.		
FS1	2A	H7	81. TF
FS2	2A	H1	81. TF
FS3	250 MA	C7	82. TF
FS4	2A	C6	117.
FS5	2A	L7	117.
FS6	100MA	C6	82. TF
FS7	36 S.W.G. CU.	H6	TM

DRAWN G. FILDES.	CHKD	USED ON TF 1066E/2 & /3	COMPONENT LIST XE34134
DATE 9.11.60.	APPD.	SHT. 5 OF 7 SHTS.	
TRACED MS	MARCONI INSTRUMENTS LTD.		

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CIR REF.	DESCRIPTION	GRID	STOCK LIST REF	CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF
	THERMISTORS						
TH1	CZ3	E6	22.TM 6412				
TH2	A15	E10	40.TM 6412				
TH3	C14	F10	41.TM 6412				

DRAWN G.F.ILDES.	CHKD	USED ON TF1066B/2 & 3	COMPONENT LIST XE 34134
DATE 1.11.60.	APPD.	SHT. 7 OF 7 SHTS.	
TRACED	MARCONI INSTRUMENTS LTD.		

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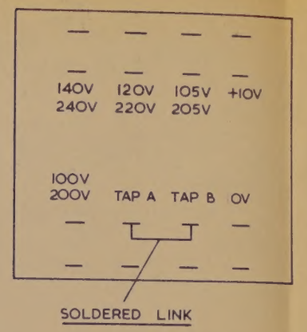
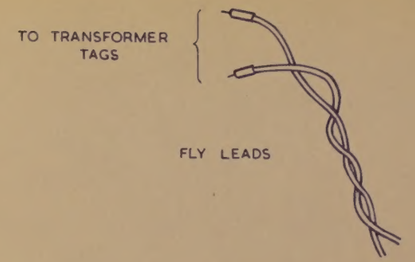
FIGURE 1

FOR 200-250 VOLTS MAINS SUPPLIES



A ARRANGEMENT OF PRIMARY SOLDER TAG CONNECTIONS ON MAINS TRANSFORMER

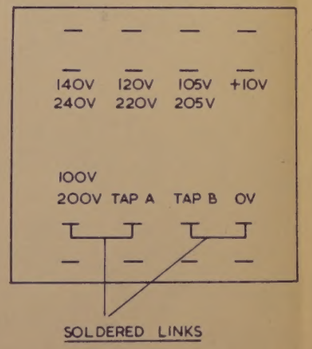


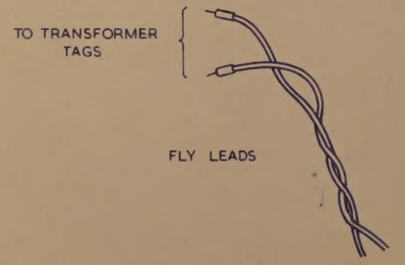
B FLY LEAD CONNECTIONS

CONNECT THE FLY-LEADS TO GIVE A COMBINATION TO SUIT MAINS VOLTAGE. ONE FLY-LEAD MUST GO TO EITHER '+10' OR '0' TAP

FIGURE 2

FOR 100-150 VOLTS MAINS SUPPLIES





MAINS INPUT CONNECTIONS

TITLE	DRG. No.
MAINS INPUT CONNECTIONS	TLC 28392
MARCONI INSTRUMENTS LIMITED	SHEET 1 OF 1 SHEETS

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